miles (42,851 / 64,654 -1 = -34%) than are calculated by the Modified Synthesis Model, used in this proceeding.[26]

Q. WHY IS THE 40% REDUCTION IN STRUCTURE COSTS RECOMMENDED BY MR. RIOLO APPROPRIATE FOR CALCULATING UNE COSTS IN THIS PROCEEDING?

A. As discussed by Mr. Riolo, the sharing of structure between feeder and distribution facilities is a characteristic of efficient outside plant design. This fact was recently recognized by the Kansas Corporation Commission, which determined that universal service costs should reflect such sharing. In its order, the Kansas Commission noted that "Staff examined the placement of feeder and distribution cable for 14 selected wire centers [and] in every case, at least 40 percent of the feeder routes also included distribution cable. In some wire centers the percentage was much higher." In response to this evidence, The Kansas Corporation Commission reduced the feeder structure and placement costs by 40%,[27] and Mr. Riolo's recommendation that we reduce the feeder structure costs in the FCC's Synthesis Model by 40% is thus consistent with these findings.

Q. HAVE OTHER PARTIES CONFIRMED THAT SUBSTANTIAL LEVELS OF SUCH STRUCTURE SHARING ARE REALISTIC?

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[26] The cited figures are found in an October 4, 2000 Ex Parte Presentation to the FCC, Federal-State Joint Board on Universal Service; CC Docket No. 96-45, Forward-Looking Mechanism for High Cost Support for Non-Rural LECs; CC Docket No. 97-160, based on Florida data.

[27] Order 16: Determining the Kansas-Specific Inputs to the FCC Cost Proxy Model to Establish a Cost-Based Kansas Universal Service Fund, Docket No. 99-GIMT-326-GIT, ¶¶52 and 54

A. Yes. As Mr. Riolo discusses, the sharing of structure by distribution and feeder facilities has been incorporated into BellSouth's Telecommunications Cost Model, recently submitted in Florida Docket No. 990649-TP, and in Louisiana Docket No. U-24714-A. In Florida, the feeder and distribution facilities share about 13% percent of the total route distance produced by the model (5,835 / 45,082 = 12%), and 74% of the feeder route was shared with distribution facilities (5,835 / 7,749 = 74%). Similarly, the equivalent data for Louisiana reveals that the feeder and distribution facilities share about 20% percent of the total route distance produced by the model (8,203 / 41,413 = 20%), and 74% of the feeder route was shared with distribution facilities (8,203 / 11,093 = 74%). Therefore, according to BellSouth's new model, failure to account for shared feeder and distribution facilities would significantly overstate feeder structure requirements and artificially inflate the network costs.

Q. HAVE YOU DOCUMENTED THE INPUTS THAT YOU HAVE REVISED?

A. Yes. Attachment G to the *AT&T/WorldCom Initial Filing* is a comparison of the default Synthesis Model inputs and the inputs I advocate using in this proceeding.

IV. CALCULATION OF ADDITIONAL UNES

Q. HOW HAVE YOU CALCULATED THE COST OF A FOUR-WIRE LOOP?

A. Four-wire loop costs are derived from the Synthesis Model output for the two-wire loop (after incorporating the recommendations above) by multiplying by a factor of 1.7. The 1.7 factor is based on engineering judgment and is supported by an analysis of the underlying costs for two-wire loops. The cost of a four-wire loop is not derived simply by doubling the cost of the two-wire loop. Such simplistic doubling would result in an overstatement of the costs of a four-wire loop because some of the two-wire loop components do not need to be doubled in order to provide a four-wire loop. Specifically, moving from a two-wire to a four-wire loop affects the following component calculations:

- NID costs should be increased by a small factor to account for an additional overvoltage protector (the estimated total investment cost of this additional component is $4, which of course is ultimately reflected in the reported monthly recurring cost) in the existing NID;
- Distribution cost should be doubled to account for the second pair;
- SAI cost should be doubled;
- Copper feeder cost should be doubled;
- Fiber feeder cost should remain unchanged. Because digital transmission is inherently four-wire, there is no increase in fiber feeder capacity required for four-wire loops. Within that portion of the transmission system that extends from the central office to the remote terminal up to the common control assembly, the cost of fiber feeder is independent of a two or four wire loop.;
- Because digital transmission is inherently four-wire, DLC common equipment cost should remain unchanged. DLC channel unit investment will increase (estimated to double) for a four-wire loop. Thus, overall DLC costs are estimated to be approximately 40% higher for a four-wire loop than for a 2-wire loop.

Attachment J to the *AT&T/WorldCom Initial Filing*, estimates the cost of the four-wire loop based on individual component changes. The results support the use of the 1.7 factor to derive the cost of the four-wire loop.

Q. HOW HAVE YOU CALCULATED THE COST OF A DS-1 AND A DS-3 LOOP?

A. Another commonly used digital signal speed is DS-3. A DS-3 line has a bandwidth of approximately 45 MB per second—equivalent to twenty-eight DS-1 lines or 672 DS-0 lines. As explained above, I have modified the DS-1 percentage inputs into the Synthesis Model to ensure that the DS-0 loop costs developed by the model include the full cable investment required for a physical two-wire loop.

As a result, to determine the cost of DS-1s and DS-3s, it is necessary to determine the number of DS-0 equivalents per physical line for DS-1s and DS-3s. Determining these ratios is a two-step process. First, the average number of DS-0 equivalents per physical line, for all non-switched lines (both DS-1s and DS-3s), was estimated to be approximately 8.[28] Second, recognizing that non-switched lines include a mix of DS-1 and DS-3 services, a method of developing different DS-0 equivalent-to-physical line ratios for DS-1s and DS-3s was devised that reconciled to the overall 8-to-1 ratio.

Making this reconciliation required two assumptions. First, the calculation assumes a 9.6-to-1 ratio between the cost of a DS-3 and the cost of a DS-1. This assumption is based on the FCC's determination *In the Matter of Transport Rate Structure and Pricing*, FCC Docket 91-213, Third Memorandum, Opinion and Order, Released December 22, 1994, da940325, ¶¶ 62,63. Second, the calculations assume that 90 percent of the non-switched lines are DS-1s, and that 10 percent of the non-switched lines are DS-3s. With

[28] This estimate is based on estimated year-end 2002 ARMIS data for special access DS-0 equivalents (as reported in the 43-08 report) and private line loops (as reported in the 43-04 report).

these two assumptions, I can calculate a DS-0 equivalent-to-physical line ratio of 4.3 for DS-1s, and a DS-0-equivalent-to-physical line ratio of 41.3 for DS-3s.[29] Because the DS-0 costs produced by the model already include line card costs that are affected by the 4.3 and 41.3 multipliers, no additional costs for electronics are included.

Q. HAVE YOU ALSO CALCULATED A FLAT SWITCH COST?

A. Yes. In addition to developing switch costs for usage and non-usage sensitive portions of the switch, I have also reported a combined flat switch cost. This calculation divides the total end office switching cost developed by the Synthesis Model by the total number of switched lines. Thus, none of the switch costs is allocated to a usage-sensitive switch category.[30]

V. RESULTS OF ANALYSIS AND CONCLUSION

Q. PLEASE SUMMARIZE YOUR TESTIMONY?

A. I have modified the FCC's Synthesis Model to correct various implementation errors and to permit its use for calculating costs for individual UNEs. In addition, I have used current expenses, investment and demand data to more accurately reflect TELRIC. Finally, I have modified the standard Synthesis Model inputs to reflect a number of

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[29] (90% * **4.3**) + (10% * **4.3** * **9.6**) = 8. (**4.3** * **9.6**) = **41.3**.

[30] This calculation is completed by dividing the total end office switching cost, reported in cell C65 of the Unit Costs worksheet of the density zone version of the expense module ("VA_C And P Tel Co Of VA_VA Direct Filing_DZ.xls") by the total switched lines reported in cell D66 of that same worksheet.

Virginia-specific inputs, including those suggested by AT&T/WorldCom witnesses Messrs. Riolo, Hirshleifer, and Lee.

Q. THE AT&T/WORLDCOM INITIAL FILING MENTIONS PROVIDING AGGREGATED LOOP COSTS BY VIRGINIA SCC'S THREE DENSITY ZONES ONCE VERIZON PROVIDES THE ADDITIONAL INFORMATION NEEDED FOR THE CALCULATION. HAVE YOU COMPLETED THIS AGGREGATION?

A. Yes. I have incorporated Verizon mapping of wire centers to rate groups for Virginia into the Synthesis Model's wire center output. However, I have not yet had sufficient opportunity to fully evaluate Verizon's mapping and these results should therefore be considered preliminary. Below is a summary of the two-wire unbundled loop costs by the TELRIC Cell IDs used in Verizon's initial filing:

Summary of Loop Costs by TELRIC Cell ID

Cell ID	Lines	NID	Distribution	Concentration	Feeder	Total Loop
Cell 1	5,392,114	$ 0.23	$ 2.09	$ 1.36	$ 1.16	$ 4.84
Cell 2	704,492	0.28	3.61	2.23	0.81	6.93
Cell 3	577,141	0.38	9.69	3.43	1.22	14.71
Average	**6,673,747**	**$ 0.25**	**$ 2.91**	**$ 1.63**	**$ 1.13**	**$ 5.92**

In addition, the attached CD-ROM, included as Exhibit E, contains the wire center version of the expense module that contains a roll-up into the three density zones.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

I, BRIAN F. PITKIN hereby swear and affirm that the foregoing direct testimony was prepared by me or under my direct supervision or control and is true and accurate to the best of my knowledge and belief.

Signed:

Witness

State : VIRGINIA
~~County~~ CITY : ALEXANDRIA

I, Jennifer L. Torregrossa do hereby swear and affirm that Brian Pitkin appeared before me this 25th day of July, 2001.

Signed:

Jennifer L Torregrossa
Notary

Notary Qualification Expires: March 31, 2003

[Stamp or Seal]

CURRICULUM VITAE

OF

BRIAN F. PITKIN

EDUCATION

University of Virginia, McIntire School of Commerce, Charlottesville, Virginia, 1993
Bachelor of Science in Commerce - Dual Concentrations in Finance and Management Information Systems

EMPLOYMENT HISTORY

Peterson Consulting, LLP, Washington, DC, 1993 - 1994
Consultant

FTI/Klick, Kent & Allen, Alexandria, Virginia, 1994 - Present
Director

TESTIMONY

United States District Court, Central District of California, Western Division

December 4, 2000 — Case No.:99-11641 RSWL (RCx). Arthur Simon and John Galley, III On Behalf of Themselves and All Persons Similarly Situated vs. American Telephone & Telegraph Crop,; At Home Corporation; Arahova Communications, Inc.; Cox Communications, Inc.; Comcast Corporation; Cablevision Systems Corp,; Garden State Cable Vision LP; Jones Intercable, Inc.; Time Warner, Inc,; Time Warner Entertainment Co., L.P.; TWE-A/N Partnership; TWI Cable, Inc.; MediaOne Group; ServiceCo L.L.C.; and Tele-Communications, Inc. Declaration of John C. Klick and Brian F. Pitkin in Support of Defendants' Motion in Opposition to Plaintiff's Motion for Class Certification.

Federal Communications Commission

May 26, 1999 — CC Docket No. 96-98. Implementation of the Local Competition Provisions of the Telecommunications Act of 1996. Affidavit of John C. Klick and Brian F. Pitkin.

May 26, 1999 — CC Docket No. 96-98. Implementation of the Local Competition Provisions of the Telecommunications Act of 1996. Affidavit of Michael J. Boyles, John C. Klick and Brian F. Pitkin.

June 10, 1999 — CC Docket No. 96-98. Implementation of the Local Competition Provisions of the Telecommunications Act of 1996. Reply Affidavit of Michael R. Baranowski, John C. Klick and Brian F. Pitkin.

Alabama Public Service Commission

February 13, 1998 — Docket No. 25980. Implementation of the Universal Support Requirements. Rebuttal Testimony of Brian F. Pitkin.

Florida Public Service Commission

September 2, 1998	Docket No. 980696-TP. Determination of the Cost of Basic Local Telecommunications Service, Pursuant to Section 364.025, Florida Statutes. Rebuttal Testimony of Don J. Wood and Brian F. Pitkin.
July 31, 2000	Docket No. 990649-TP. Investigation into Pricing of Unbundled Network Elements. Rebuttal Testimony of John C. Donovan and Brian F. Pitkin.
August 28, 2000	Docket No. 990649-TP. Investigation into Pricing of Unbundled Network Elements. Supplemental Rebuttal Testimony of John C. Donovan and Brian F. Pitkin.

Georgia Public Service Commission

August 1, 2000	Docket No. 5825-U. Universal Access Fund, Transition to Phase II Pursuant to O.C.G.A. § 46-5-167. Direct Testimony of John C. Donovan and Brian F. Pitkin.
September 8, 2000	Docket No. 5825-U. Universal Access Fund, Transition to Phase II Pursuant to O.C.G.A. § 46-5-167. Rebuttal Testimony of John C. Donovan and Brian F. Pitkin.
October 2, 2000	Docket No. 5825-U. Universal Access Fund, Transition to Phase II Pursuant to O.C.G.A. § 46-5-167. Reply to Rebuttal Testimony of John C. Donovan and Brian F. Pitkin.

State Corporation Commission of the State of Kansas

May 25, 1999	Docket No. 99-GIMT-326-GIT. Investigation into the Kansas Universal Service Fund (KUSF) Mechanism for the Purpose of Modifying the KUSF and Establishing a Cost-based Fund. Direct Testimony of Brian F. Pitkin.

Maryland Public Service Commission

March 23, 2001	Case No. 8745. In the Matter of the Provision of Universal Service to Telecommunications Consumers. Direct Testimony of Brian F. Pitkin.
May 21, 2001	Case No. 8745. In the Matter of the Provision of Universal Service to Telecommunications Consumers. Rebuttal Testimony of Brian F. Pitkin.
May 25, 2001	Case No. 8879. In the Matter of the Investigation into Rates for Unbundled Network Elements Pursuant to the Telecommunications Act of 1996. Direct Testimony of Brian F. Pitkin.
June 11, 2001	Case No. 8745. In the Matter of the Provision of Universal Service to Telecommunications Consumers. Surrebuttal Testimony of Brian F. Pitkin.
July 24, 2001	Case No. 8879. In the Matter of the Investigation into Rates for Unbundled Network Elements Pursuant to the Telecommunications Act of 1996. Supplemental Direct Testimony of Brian F. Pitkin.

Minnesota Public Utilities Commission

July 14, 1998	Docket No. P-442, 5321, 3167, 466, 421/CI-96-1540. Commission's Generic Investigation of U S West Communications, Inc.'s Cost of Providing Interconnection and Unbundled Network Elements. Supplemental Direct Testimony of John C. Klick and Brian F. Pitkin.

Mississippi Public Service Commission

March 6, 1998	Docket No. 98-AD-035. Mississippi Universal Service Docket. Rebuttal Testimony of Brian F. Pitkin.

Public Service Commission of Missouri

September 25, 1998	Docket No. TO-98-329. Investigation into Various Issues Related to the Missouri Universal Service Fund. Rebuttal Testimony of Brian F. Pitkin, adopted by John C. Klick.

Public Service Commission of the State of Montana

December 31, 1997	Docket No. D97.9.167. Investigation of the Commission Implementation of a Forward Looking Universal Service Cost Model. Direct Testimony of Brian F. Pitkin, adopted by Michael Hydock.
February 13, 1998	Docket No. D97.9.167. Investigation of the Commission Implementation of a Forward Looking Universal Service Cost Model. Supplemental Testimony of Brian F. Pitkin, adopted by Michael Hydock.
February 20, 1998	Docket No. D97.9.167. Investigation of the Commission Implementation of a Forward Looking Universal Service Cost Model. Rebuttal Testimony of Brian F. Pitkin, adopted by Michael Hydock.

Telecommunications Regulatory Board of Puerto Rico

May 1, 2001	Case No.'s 97-Q-0001 & 97-Q-0003 In the matter of Puerto Rico Telephone Company Tariff K-2. Direct Testimony of Brian F. Pitkin.
May 15, 2001	Case No.'s 97-Q-0001 & 97-Q-0003 In the matter of Puerto Rico Telephone Company Tariff K-2. Rebuttal Testimony of Brian F. Pitkin.

South Carolina Public Service Commission

November 10, 1997	Docket No. 97-239-C. Intrastate Universal Service Fund. Adopted the Direct Testimony of John C. Klick.
March 2, 1998	Docket No. 97-239-C. Intrastate Universal Service Fund. Rebuttal Testimony of Brian F. Pitkin.

Tennessee Regulatory Authority

April 9, 1998	Docket No. 97-00888 (USF). Universal Service Generic Contested Case. Rebuttal Testimony of Don J. Wood and Brian F. Pitkin.

Public Utility Commission of Texas

July 16, 1998	Docket No. 18515. Compliance Proceeding for Implementation of the Texas High Cost Universal Service Plan. Live Rebuttal Testimony of Brian F. Pitkin.

Washington Utilities and Transportation Commission

August 3, 1998	Docket No. UT-980311(a). Determining Costs for Universal Service. Testimony of Brian F. Pitkin.
August 24, 1998	Docket No. UT-980311(a). Determining Costs for Universal Service. Rebuttal Testimony of Brian F. Pitkin.

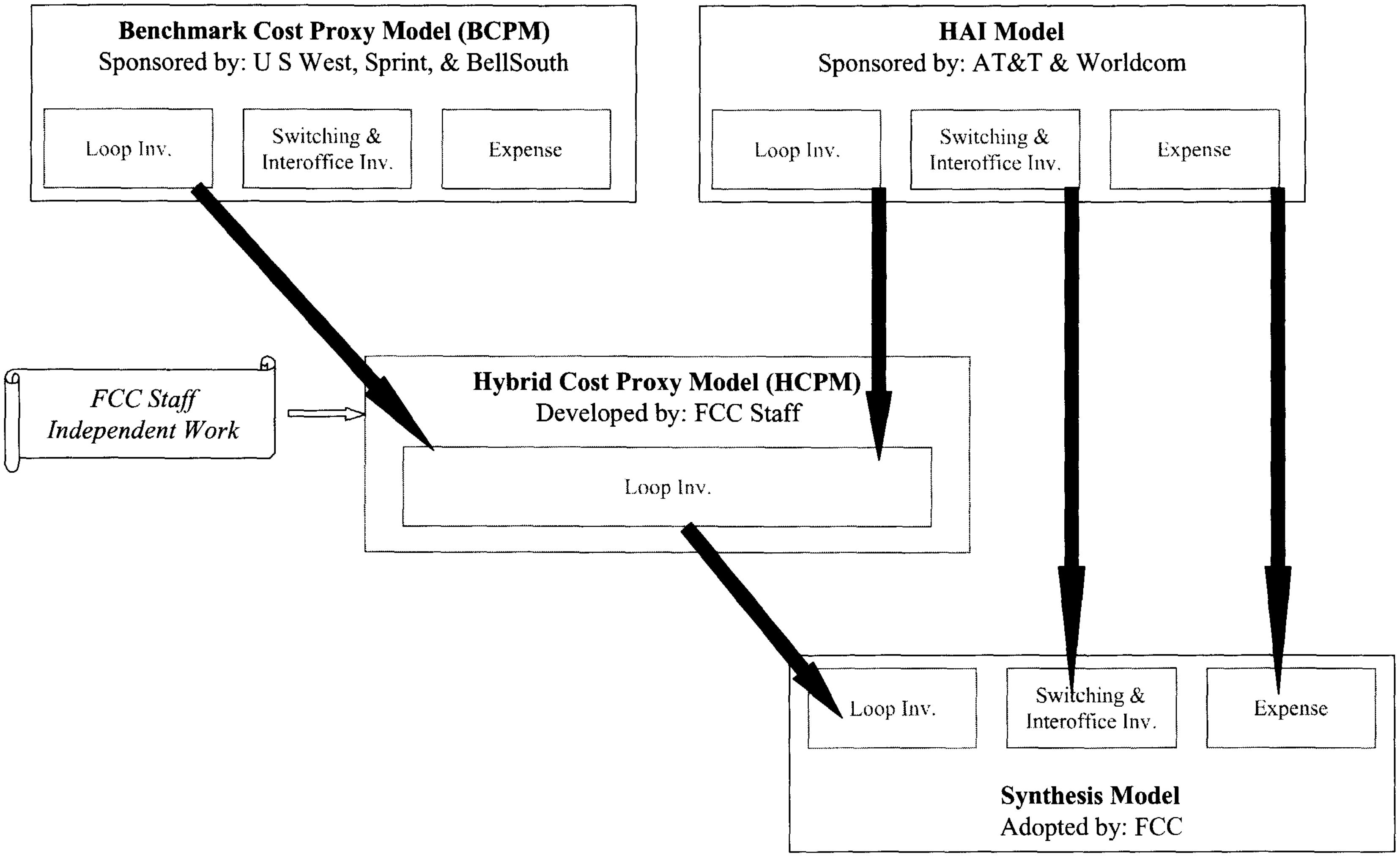
Public Service Commission of the State of Wyoming

January 23, 1998	General Order No. 81. Investigation by the Commission of the Feasibility of Developing Its Own Costing Model for Use in Determining Federal Universal Service Fund Support Obligations in Wyoming. Direct Testimony of Brian F. Pitkin.
February 6, 1998	General Order No. 81. Investigation by the Commission of the Feasibility of Developing Its Own Costing Model for Use in Determining Federal Universal Service Fund Support Obligations in Wyoming. Rebuttal Testimony of Brian F. Pitkin.

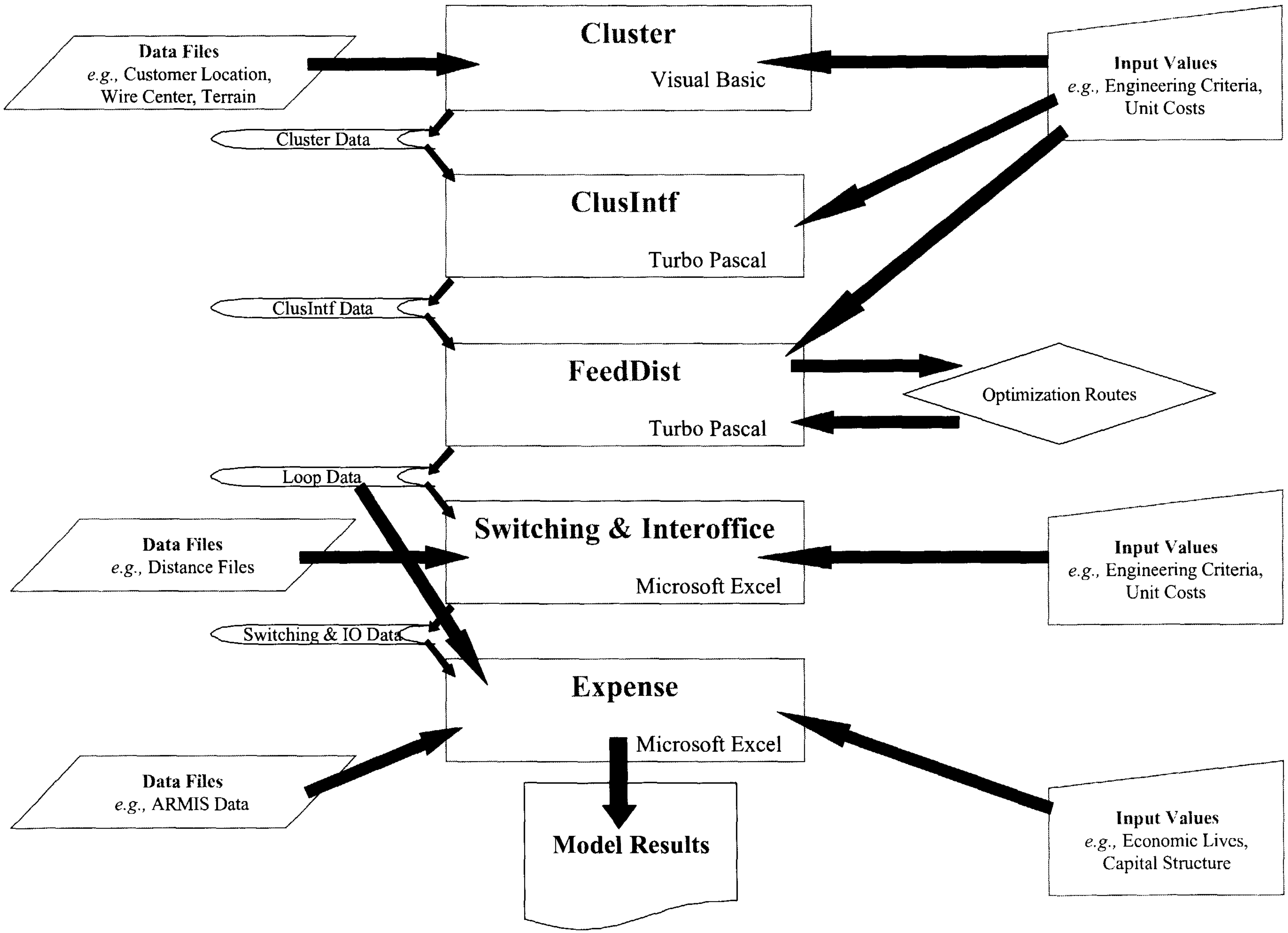
County Board, Arlington Virginia

August 5, 2000	Consideration of the January 18, 2000 Application of Starpower Communications, LLC for an Arlington County Certificate of Public Convenience and Necessity for Cable Television. Testimony of Brian F. Pitkin.

Synthesis Model Development



Synthesis Model Flowchart



Detailed Description of Synthesis Model Source Code Changes

I. DROP TERMINAL DISPERSION

The Synthesis Model determines drop locations based on the number of lots within each microgrid and is "designed to serve groups of four properties wherever possible." (Computer Modeling of the Local Telephone Network, October 1999, Page 9) These drop terminals are intended to be placed along lot lines, between the lots they serve.

The model incorrectly identifies drop terminal locations by placing them outside of the underlying microgrid to which they are assigned. This error occurs because the distribution algorithms use a hard-coded microgrid width of 1,000 feet for spacing drop terminals, instead of using the actual microgrid width. With a default value of 360 feet, the hard-coded 1,000 feet forces the distribution algorithms to place drop terminals outside of their assigned microgrid, thereby exaggerating the drop terminal dispersion.

For example, assume the model determines that a drop terminal should be placed in the center of the microgrid (½ of the east-west microgrid distance from the left border and ½ of the north-south microgrid distance from the bottom border). In addition, assume that the model uses the default microgrid size of 360 feet. The current methodology places the drop terminal 500 feet (½ * 1,000 feet) up from the bottom of the microgrid and 500 feet (½ * 1,000 feet) from the left edge of the microgrid. Because each microgrid is only 360 feet by 360 feet, this drop terminal would be placed in the microgrid above and to the right of the intended microgrid. The correct formula should place the drop terminal 180 feet (½ * 360 feet) up from the bottom of the microgrid and 180 feet (½ * 360 feet) from the left edge of the microgrid. In this example, the current drop terminal location is 453 feet (SQRT($(500-180)^2+(500-180)^2$)) from its intended location.

Attachment 1 illustrates this error using four microgrids in a Cluster. The Synthesis Model erroneously places these drop terminals using a 1,000-foot microgrid (represented by the dotted lines) instead of the actual 360 foot microgrid (represented by the thick solid lines) containing the actual customer locations that those drop terminals are intended to serve. Attachment 2 represents the placement of drop terminals after correcting this coding error.

II. DROP TERMINAL ORIENTATION

The Synthesis Model places the drop terminal locations toward the northeast corner of the microgrid. This methodology is only appropriate when evaluating a cluster's lower left quadrant. For drop terminals in any other quadrant of the cluster, the model places drop terminals away from the serving SAI/FDI.

Attachment 2 shows the current orientation of drop terminals. Attachment 3 illustrates the correct orientation of drop terminals relative to the serving SAI/FDI. Comparing Attachment 3 to Attachment 2 shows this shift of drop terminals toward the SAI/FDI location. This modification prevents the model from placing drop terminals beyond the customer location and then back-feeding the drop to the customer.

III. LOT SIZES / CONFIGURATION

The model documentation states that "[c]ustomers within each microgrid cell are assumed to be uniformly distributed within the cell." (Computer Modeling of the Local Telephone Network, October 1999, Page 7). According to the source code documentation, the model "minimizes wasted lots within a square microgrid, subject to the constraint that lots have lengths no more than twice their widths."[6] The model intends to uphold this constraint by performing a "[c]heck from square root of number of lots/2 to square root of number of lots. This [should] guarantee that max length - width ratio is no more than 2."

However, the Synthesis Model algorithms do not correctly implement the stated constraint. In other words, the model fails to consistently produce lot configurations with lot depths less than twice the width. Attachment 3 highlights the lot configuration error. Both microgrids south of the SAI/FDI, for example, have lot depths greater than twice their width (the lot depths are 3 times the lot width, thereby causing the model to construct a three-by-one lot structure within a microgrid). Attachment 4 shows the same microgrids corrected to create the intended lots size and configuration. A comparison of these diagrams shows that the number of drop terminals are reduced in the two microgrids south of the SAI/FDI (from two to one) and the number of drop terminals are increased in the microgrid northwest of the SAI/FDI (from three to four). I have also included, as Attachment 5, a comparison between the numbers of lots and drop terminals the Synthesis Model currently calculates versus the number of lots and drop terminals with our correction.

IV. INPUT VARIABLES

The Synthesis Model, in several instances, incorrectly sizes outside plant equipment. The first error occurs in selecting the drop terminal size. Instead of selecting the next largest drop terminal size for a given number of lines, the model selects the next smallest drop terminal size.

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[6] This source code is found in the Turbo PASCAL program entitled lotdiv.pas.

Therefore, if a drop terminal needs to serve four lines, the model will incorrectly select a terminal intended for one line instead of the six-line drop terminal. Similarly, the model undersizes the manholes in the Synthesis Model. For example, the model incorrectly selects a two-duct manhole when three ducts are required rather than appropriately selecting a four-duct manhole. Again, the model selects a SAI/FDI size that is too small to serve the line demand. Finally, the Synthesis Model incorrectly uses the buried sharing fraction for underground plant and the underground sharing fraction for buried plant. While this transposition problem does not impact the model's default run, because the sharing values are the same, it should be fixed to recognize the appropriate input values.

V. RESIDUAL LINE ALLOCATION

The Synthesis Model assigns lines to grids within a cluster based on the original customer location. Thus, the model originally captures the variation in density between grids of a cluster. As a necessary step, the model calculates the residual number of lines because the input data includes the number of residential lines or business lines associated with each location, which is often a fractional number (e.g. 1.4 lines per location). However, this process incorrectly occurs at each location within a grid rather than for the entire grid. By doing so, the Synthesis Model exaggerates the necessary number of residual lines to be randomly reallocated, resulting in an inaccurate representation of the microgrid's actual line counts. In effect, this process serves to undo some of the variation in density between grids of a cluster by randomly distributing an artificially high number of residual lines.

As an example, if a microgrid has 9 locations assigned to it, each with 1.4 lines, the model would round each of the 1.4 lines to 1 line before adding it to the microgrid line count. This process yields 9 lines, with 3.6 residual lines. If, instead, the model rounds line counts after adding all lines in a microgrid together, the microgrid would be assigned 13 lines with -0.4 residual lines. The following table illustrates the current methodology:

Microgrid 1

Customer	No. of Lines	Assigned Lines	Residual Lines
1	1.4	1	0.4
2	1.4	1	0.4
3	1.4	1	0.4
4	1.4	1	0.4
5	1.4	1	0.4
6	1.4	1	0.4
7	1.4	1	0.4
8	1.4	1	0.4
9	1.4	1	0.4
Total	12.6	9	3.6

If a second microgrid within the same cluster has 1 location, also with 1.4 lines, the model would calculate the number of lines as follows:

Microgrid 2

Customer	No. of Lines	Assigned Lines	Residual Lines
1	1.4	1	0.4
Total	1.4	1	0.4

The model then calculates the residual number of lines within the cluster. The number of residual lines is the total lines, without rounding, minus the number of assigned lines (14.0 – 10.0 = 4 residual lines). These residual lines are then randomly distributed to the populated microgrids within the cluster. In this case, the model could assign all 4 residual lines to microgrid 2 resulting in only 9 lines assigned to microgrid 1 and 5 lines assigned to microgrid 2.[7] Therefore, the Synthesis Model tends to result in too many residual lines being randomly allocated to microgrids instead of maintaining the original line counts to the extent possible.

A more appropriate methodology sums all of the lines assigned to a microgrid and then rounds that number. This would result in Microgrid 1 having 13 lines (12.6 rounded to 13) and Microgrid 2 having 1 line (1.4 rounded to 1). In this case, there would be no residual lines. This modification minimizes the number of residual locations that need to be randomly distributed and helps ensure that each microgrid maintains as much original data as possible.

Referring back to Attachment 3, it shows that the model is constructing lots for three customers in each of the lower microgrids. However, each of these microgrids has only two customers (represented by stars). During the residual line allocation, the Synthesis Model incorrectly, and randomly, reassigns lines (and therefore customers) to these microgrids. Modifying the residual line allocation will help to minimize the number of lines randomly assigned and also minimize the number of customers reassigned. Stated differently, this modification will keep customers and lines assigned to the microgrids they were originally associated with and will retain the variation in density within a cluster.

VI. NODE SELECTION CRITERIA

The Synthesis Model contains a Prim algorithm that is used to 1) connect all drop terminals to the serving SAI/FDI and 2) connect all SAIs/FDIs to the serving central office. The FCC

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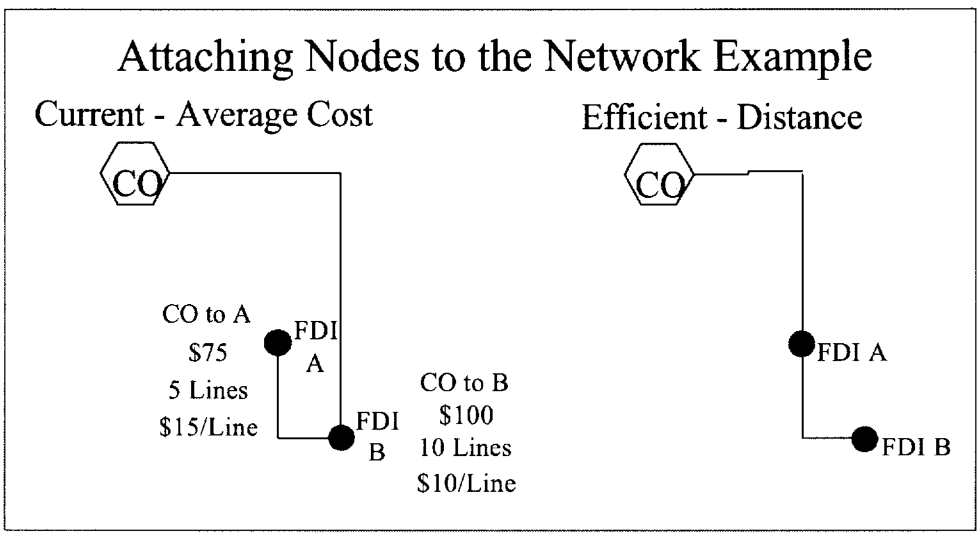
[7] While this could happen based on the random number generator, the more likely scenario is that the model would assign 2 lines to microgrid 1 and 2 lines to microgrid 2. However, this still shifts lines from microgrid 1 to microgrid 2.

modified the Prim algorithm to consider <u>average</u> cost, not <u>distance</u>, when evaluating which node to connect to the existing network next. The model documentation states:

> [t] he second modification of the Prim algorithm is in the rule which is used to attach new nodes to the network. Rather than minimizing the distance from an unattached node to the existing network, the algorithm minimizes the total cost of attaching an unattached node, and of constructing all of the lines that are required to carry traffic from that node back to the central office." (Computer Modeling of the Local Telephone Network, October 1999, Page 12)

I have found that applying the average cost methodology, rather than distance, causes the model to back-feed portions of the network and produce a less optimal design. The following diagram illustrates this problem:

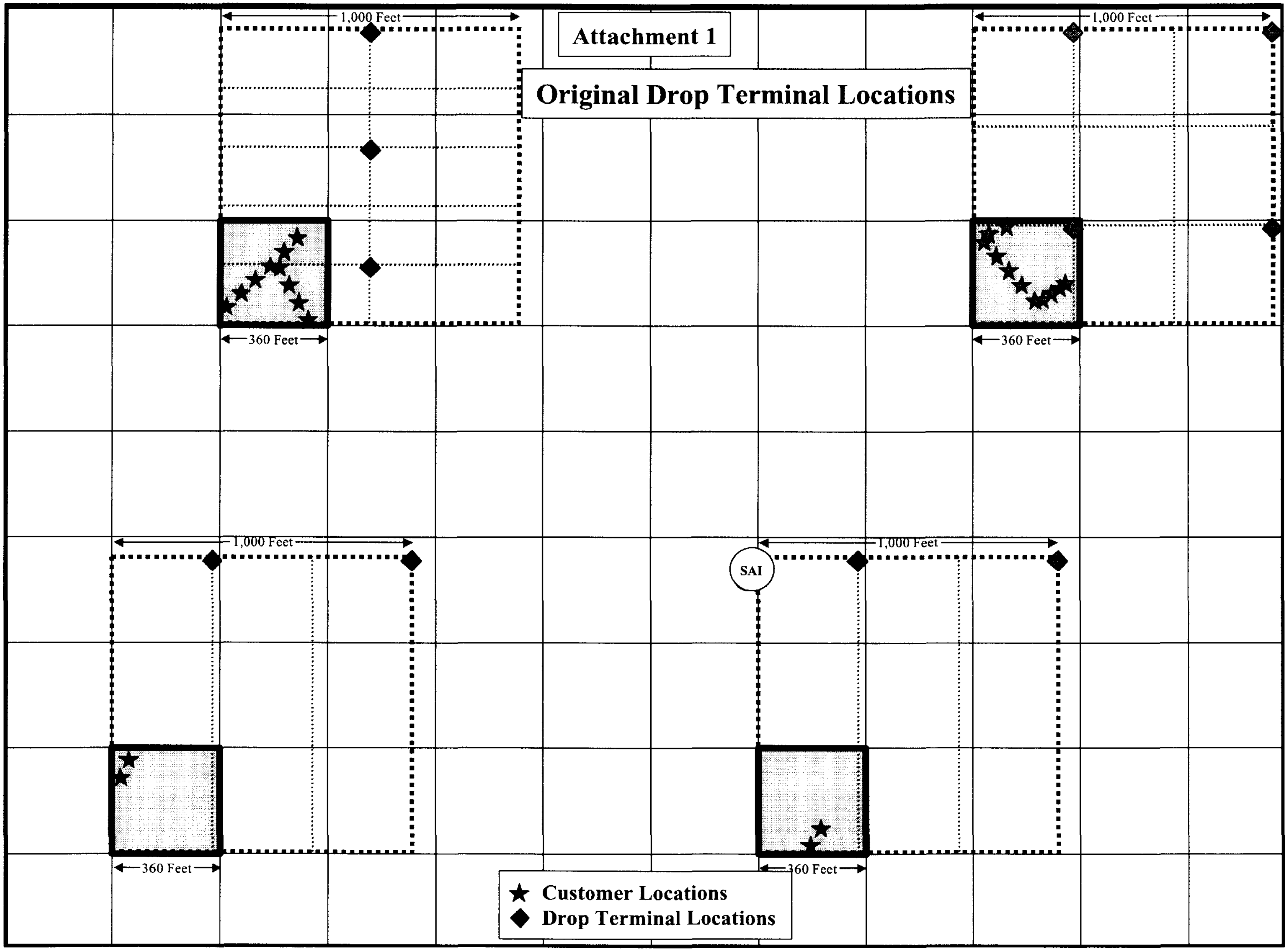


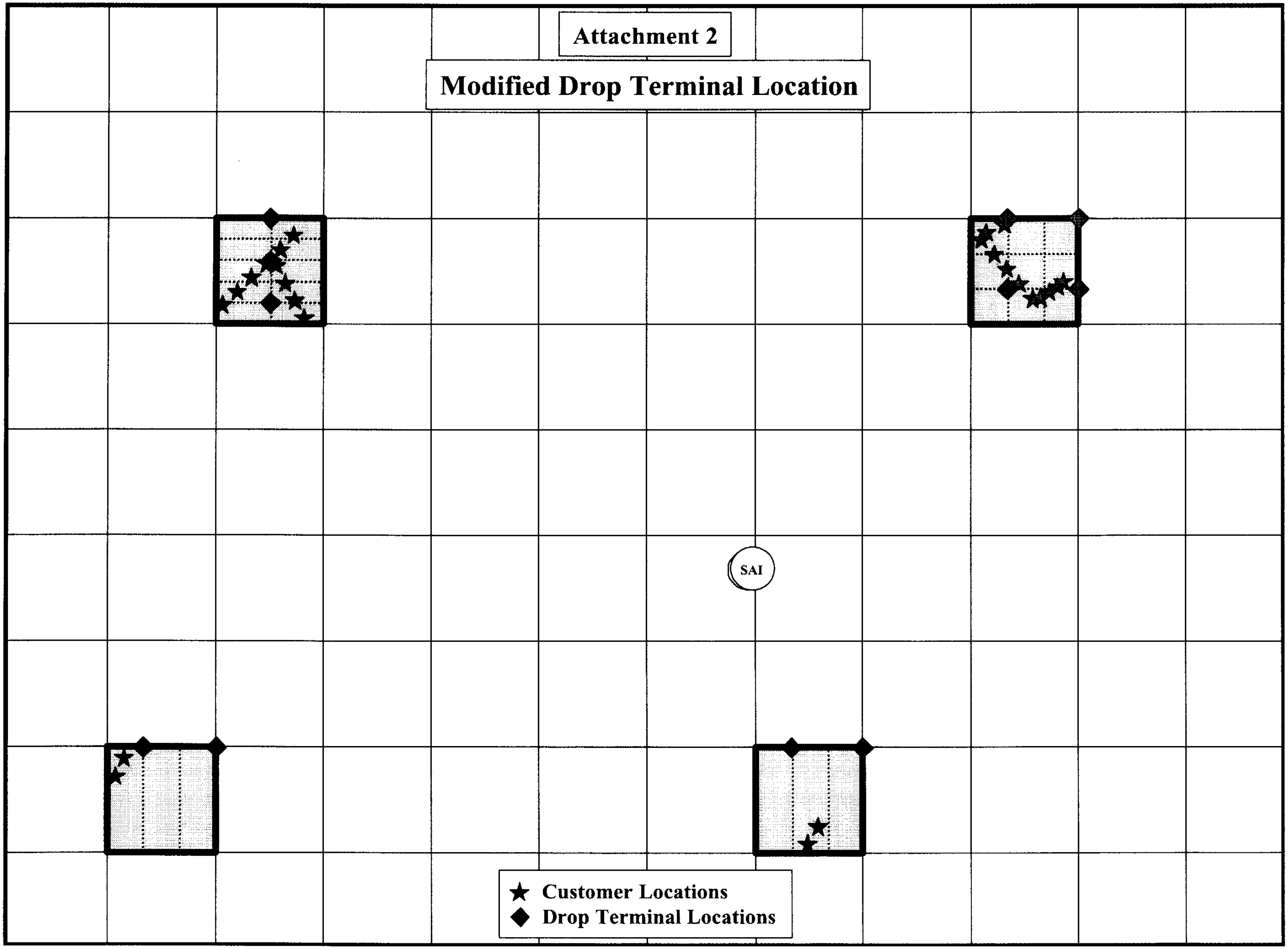
Using an average cost criteria to connect nodes causes the Synthesis Model to connect densely populated, more distant SAIs/FDIs (location B in the above diagram) before closer, less dense SAIs/FDIs (location A in the above diagram). Therefore, the model builds duplicative plant under this criteria. The Prim algorithm should be modified to evaluate attaching nodes to the network based on distance because this generally creates the lower-cost network.

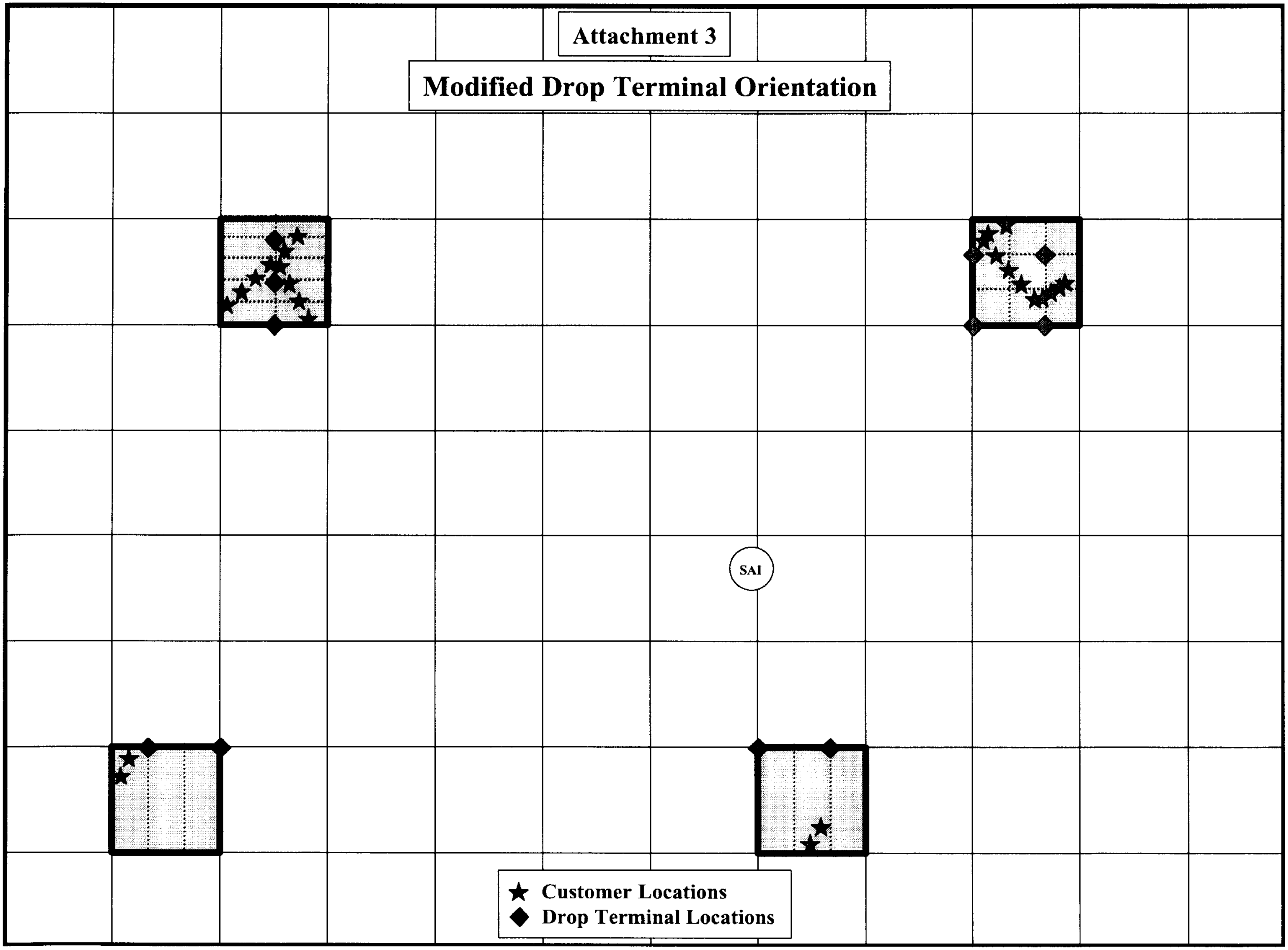
VII. OVERLAPPING MICROGRIDS

The Synthesis Model currently creates a 500-foot buffer around a cluster's customer locations. Because the model evenly distributes lots within each populated microgrid, this buffer causes customer lots, and drop terminals, to overlap between clusters. Attachment 6 illustrates this point for neighboring clusters; Eliminating the 500-foot buffer ensures that the Synthesis Model does not place duplicative and overlapping plant.

The FCC Staff used the 500-foot buffer in original versions of the Synthesis Model that used CBG data, not geocoded customer locations (either actual or surrogate). The intent of this criterion was to ensure that the farthest customer would not violate the maximum copper distance in earlier versions of the model.


Attachment 1
Original Drop Terminal Locations
1,000 Feet
1,000 Feet
360 Feet
360 Feet
1,000 Feet
1,000 Feet
SAI
360 Feet
360 Feet
Customer Locations
Drop Terminal Locations


Attachment 2
Modified Drop Terminal Location
SAI
Customer Locations
Drop Terminal Locations


Attachment 3
Modified Drop Terminal Orientation
SAI
Customer Locations
Drop Terminal Locations